STATE BRIDGE No. 0302150
Route U.S. 9, spanning the Bass River
New Gretna vicinity
Burlington County
New Jersey

HAER No. NJ-123

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PHOTOGRAPHS
WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
Northeast Region
Philadelphia Support Office
U.S. Custom House
200 Chestnut Street
Philadelphia, Pennsylvania 19106

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HISTORIC AMERICAN ENGINEERING RECORD

STATE BRIDGE No. 0302150

HAER No. NJ-123

Location:	Route U.S. 9, spanning the Bass River New Gretna vicinity, Burlington County, New Jersey UTM: 18.547820.4382580 Quadrangle: New Gretna, N.J., 1:24,000
Date of Construction:	1923-1925
Designer:	Strauss Bascule Bridge Company, Chicago, Illinois (bridge) New Jersey Department of Highways (operator's house, office, and locker room)
Fabricator:	Fort Pitt Bridge Works, Pittsburgh, Pennsylvania
Builder:	L.J. Seiling, Red Bank, New Jersey
Present Owner:	New Jersey Department of Transportation 1035 Parkway Avenue Trenton, New Jersey 08625
Present Use:	Bridge
Significance:	This single-leaf, trunnion bascule bridge is a well-preserved example of a patented Strauss articulated underneath counterweight structure. It is significant for its use of chain-driven operating machinery powered by a gasoline engine, and it may be the only example of a gasoline engine powered bridge in the State of New Jersey. The bridge has been little altered from the time of its construction.
Project Information:	New Jersey Department of Transportation plans to replace this bridge with a new bridge on a new alignment. The new bridge alignment will allow improved sightlines, while the bridge itself will not be weight-restricted. The present bridge will be demolished.
Preparers of Documentation:	Richard Meyer/Senior Project Manager Douglas C. McVarish/Project Architectural Historian John Milner Associates, Inc. 309 North Matlack Street West Chester, Pennsylvania 19380 1998

DESCRIPTION OF PROPERTY AND SETTING

State Bridge No. 0302150 is located at the Route U.S. 9 crossing of the Bass River in Bass River Township, Burlington County, New Jersey, approximately 730m (2,400 feet) east of the center of the village of New Gretna and 60m (200 feet) southeast of a Garden State Parkway overpass. Until the completion of the Garden State Parkway in the 1950s, Route U.S. 9 was the major north-south highway along the Atlantic coast of New Jersey. This highway extends the length of the state, entering New Jersey from New York near the Hudson River and terminating at Cape May.

The bridge is located about 3.85km (2.4 miles) from the mouth of the Bass River, a river that flows into the Mullica River and subsequently into the Great Bay. Although the moving leaf is infrequently raised, the owner of at least one property north of the bridge has a boat of sufficient size to require the bridge to be opened.

The Strauss Trunnion Bascule Bridge

State Bridge No. 0302150 is a Strauss trunnion bascule bridge, which consists of a central bascule span with two approach spans. The approach spans are paved in asphalt over boards and are supported by a dense network of timber pilings anchored to the bottom and banks of the river. As originally constructed, the bascule span had a road surface consisting of 18 by 1/2 inch grooved planks, fastened with countersunk bolts over 3-inch creosoted wood blocks and 4 inch subplanking. This surface has been replaced with a steel grid deck. The bascule span measures 36 feet 6 inches long with a 30 foot wide clear roadway. The bridge curbing was originally constructed of 4 x 8 foot creosoted boards resting on 2 x 8 x 1 foot creosoted beams spaced approximately 2 feet 6 inches on center. Two inch diameter galvanized metal pipe railings are cantilevered from the outer I-beams of the moving leaf substructure. The lowest point of the superstructure of the bridge is 12.46 feet above mean low water, and 9.4 feet above high water.

The approach spans have railings constructed of three parallel painted wood boards mounted to square wood posts. The bridge is composed of 18 short timber stringers supported on pile bents, approach spans, and a single-leaf deck girder moveable span with articulated underneath counterweight. The moveable span pivots on two trunnions which bear on built-up trunnion towers or columns on a concrete pier. The articulated concrete counterweight moves on linkage and is located under the tail of the moveable span. The manual lattice warning gates and manual locks, operated by a hand lever, are both original to the span. A wood-framed, gable-roofed, operator's office is located on the east end of the downstream side of the moveable span, while the operator's house is located near the center of the same side.

As significant as the moveable span is the operating machinery. The lift machinery is chain rather than gear driven, and the power source is a Hercules-manufactured gasoline engine. The chain drive may have been selected because of the distance between the engine (power source) and line shafts. Such an arrangement protects the engine from water damage. Three sets of chains and sprockets are used in the operation of the span. The first speed reduction chain services the reversing gear control to raise and lower the bridge. The second speed reduction chain connects the reversing unit output shaft to a drive sprocket on the first line shaft located under the bridge. A third reduction chain and sprocket powers the secondary transverse shaft with the pinion that engages the segmental rack which raises and lowers the bridge. The operating mechanism appears to be original and unmodified except for routine maintenance such as replacement of drive chains. Changes to the other elements of the bridge appear to have been normal maintenance rather than modification or alteration. With the exception of new concrete piers for the first line shaft, the bridge appears to remain as built.

Three wood-framed structures are associated with the bridge. A locker room/privy and operator's office are situated south of the east approach span on the east bank of the river, while the operator's house is located on the south side of the bridge adjacent to the bascule span. The locker room/toilet is a narrow, gable-roofed, clapboarded, wood-framed structure. Its roof gable overhangs its south wall. The interior is divided into two rooms. This structure adjoins a driveway east of the bridge. The office, a larger, single story, wood-framed, clapboarded structure, is raised on creosoted wood pilings. A recently constructed deck is cantilevered from the south, east, and west sides, and wooden steps provide access to the parking area below. Fenestration consists of six over one, double hung windows. The interior of the office has board walls, a sheetrock ceiling, and a floor covered in linoleum tile. No bridge machinery is contained within the structure.

The operator's house, a small, single-story, clapboarded, pyramidal hip-roofed building, shelters the gasoline engine that powers the bridge. This building has a three panel door placed off-center in its east wall and is fenestrated with two over two, double hung sash windows. It measures approximately 10.5 feet wide and 11.6 feet deep. The interior has beaded board walls and a board ceiling. The operator's house sits atop a steel substructure anchored to a concrete pier in the middle of the river. The building contains the gasoline engine that provides power for the moving leaf. Three operating levers are located near the engine: the brake lever, the clutch lever, and the reversing lever. The brake lever is connected to the emergency brake. This brake consists of an 18 inch in diameter wheel with paired asbestos-lined brake shoes.

Specifications for the bridge indicated that the gasoline engine has a bevel gear reversing unit and that it develops 15 horsepower at 1,000 R.P.M. Power is transmitted to the bridge mechanism by a series of mitre gears and bearings connected by shafts. The operating machinery of the bridge is shown in photographs 20 and 21. The power generated turns a 14-tooth sprocket and a 30-tooth sprocket. The latter is linked to a 60-tooth sprocket by a metal chain of 25,000 pounds strength. This mechanism drives a rack and pinion that raises and lowers the main trunnion. The trunnion is anchored to the riveted steel trunnion posts by two steel trunnion bearings with phospher-bronze bushings and linings. These bearings are designed to provide the lubrication required by the main trunnion. As the bridge moves, the counterweight trunnion adjusts the position of the counterweight to counterbalance the moving bridge leaf. A bumping block anchored to a trunnion post prevents the bridge from moving beyond its 81 degree angle of opening.

The concrete counterweight has its sides, ends, and bottom surface reinforced with 3-inch wire netting or expanded metal weighting. Reinforcing rods are 5/8 inch in diameter. Some deterioration of the concrete is evident.

After the bridge leaf has returned to its horizontal position, it is locked in place. The lock bar lever is at the west end of the bascule span. The lever is joined by a socket to a 1 1/2 inch diameter steel rod threaded through lock bar guides. A padlock prevents unauthorized opening of the bridge.

The river channel is marked north and south of the bridge to insure that marine traffic passes beneath the moving leaf. This channel is defined by bundled timber pilings coated with creosote. Parallel horizontal boards connect these pilings and are anchored to the pilings of the approach spans.

The bridge is equipped with two pairs of original hand-operated gates. These gates hang from tall cylindrical metal gate posts crowned with ball finials. In addition, the bridge is equipped with automatic warning gates, synchronized with traffic signals operated by switches located in the operator's house.

BACKGROUND HISTORY

Route U.S. 9, originally known as Route 4 in New Jersey, was among the original State Highways of New Jersey provided for in a series of legislative acts. The first attempt to establish a state highway system was made in Chapter 396 P.L. 1912, "An act to establish a State System of Highways..." that provided for 1,350 miles of highways, including the Ocean Highway and the Delaware River Drive. Little was done other than the selection of routes, because the Legislature failed to provide adequate appropriations.

In 1916, the Legislature passed Chapter 285, Public Laws 1916, known as the "Egan Good Roads Law." This law provided for a State Highway System of 13 specific routes encompassing 550 miles of highway to be established at a cost of $7 million. The final funding for the system was substantially greater than $7 million and was specified in subsequent legislation known as "Edge Acts." These acts also empowered the State Highway Commission to lay out 15 routes and specified the materials to be used in highway construction. At 110 miles in length, Route 4 was the longest of the highways authorized by these acts. It was described as follows:

> From a point on Route No. 1 near Rahway to Absecon....From Rahway over existing roads to Perth Amboy, thence over Perth Amboy-South Amboy bridge to South Amboy. Surveys were made of three lines from South Amboy to Morgan.... From Morgan, route as surveyed is via Keyport, Middletown, Red Bank, Eatontown, Long Branch, Asbury Part, Point Pleasant, Lakewood, Toms River, Tuckerton, and New Gretna, to Absecon. No important changes from existing roads are contemplated between Morgan and Absecon except flattening of existing curves and possible slight changes near Manasquan, and elimination of some existing railroad crossings and bridges by acquiring private property (NJSHD 1918:19).

Initial expenditures for the system were paltry. In 1918, funding permitted improvements to be planned for only 6.6 miles of highway, and only 3.5 miles was under construction. Construction of an additional 1.85 miles was planned for the following year. A substantial increase in construction resulted from active lobbying for the state highway system. In 1918, John W. Herbert, Chairman of the New Jersey State Highway Commission, wrote of the system's importance to the state:

> Of course the money consideration outweighs all others, but we must not forget that only by the expenditure of money do we conserve wealth and breed more wealth...Our economic foundation...is based upon our transportation systems: rail, water and highway. To allow one of these systems to deteriorate or disintegrate will exact a cost far out of proportion to the sums required to maintain it....It is the hope of the writer that ways and means can be devised by all concerned to permit the establishment of the New Jersey State Highway System to go on without delay or interruption. The economic needs of this great industrial State demand it... (Herbert 1918:84).

Between 1917 and 1924, 54% of the 111.666 mile length of Route 4 had been completed. Construction had begun on a new bridge over the Bass River. In 1925, contracts were awarded for additional route sections. Among these was the 6.409 mile section between Tuckerton and New Gretna in Ocean and Burlington counties, including the approaches to State Bridge No. 0302150. The contract for this reinforced concrete highway section totaled $303,510.42. By the end of 1925, 103.846 miles or 93% of Route 4 had been completed (NJSHE 1926a). By the end of the following year, all of Route 4 had been completed, and the state highway system totaled over 1,459 miles of roadway. The coast road had been completed to Cape May with Route 4 joining Route 14.

Plans for State Bridge No. 0302150 were approved by the U.S. Army Corps of Engineers on February 8, 1923 (COE 1942:28), and the contract for its construction was let in the same year. The original contract amount was $106,860.11, later raised to $122,872.33. The steel structure of the bridge was fabricated by the Fort Pitt Bridge Works of Pittsburgh (NJDOT engineering drawings). Work on the bridge was started on December 11, 1923. The bridge construction fell behind schedule, and the project, which was anticipated to be completed within 150 working days, took well over a year. The reason for these delays is not clear. The bridge contractor was L.J. Seiling of Red Bank, New Jersey. According to the State Highway Engineer's Report for the year ended December 31, 1924, as of that time, work was 94.5% completed, and a total of $104,403.12 had been expended on the bridge (NJSHE 1925:31). Work on the bridge was fully completed on March 10, 1925 (NJSHE 1926a). The bridge was later inspected by the U.S. Army Corps of Engineers and was officially opened on October 29, 1926 (COE 1942:28).

The Technology of the Bascule Bridge

C.B. McCullough, writing in *Movable and Long-Span Steel Bridges*, described the genesis of the bascule bridge:

> The earliest type of bascule construction doubtless consisted of a simple span, trunnioned or hinged at one end, moving in a vertical plane, about such trunnion, by virtue of an out-haul line attached to the free end and running upward and inward to the source of power....These types and the earlier modern types were not counterweighted to any extent and their field of utility was, therefore, quite restricted (McCullough 1923:1).

The modern bascule bridge developed from the medieval drawbridge. These medieval prototypes were one of two basic designs. In one design, the direct predecessor of the modern bascule bridge, the leaf was raised up, closing off the gateway. In the other design, the leaf hung down into the moat. French architect Viollet-le-Duc showed several designs for these medieval bridges in his treatise, *Dictionnaire Raissoné de l'Architecture* (Whitney 1929:225, 227).

According to bridge historian and engineer Otis Ellis Hovey, the modern bascule bridge postdated the development of the practical steam locomotive in the early nineteenth century. Among the earliest modern bascule bridges was a single-leaf, single-lever bascule erected over Bowcombe Creek in Kingsbridge, Devon, England. The bridge was operated by a hydraulic pump which moved a rack, driving a pinion on a drum shaft on which a chain was wound, raising the end of the leaf. Other early modern bascule bridges included a small trunnion bascule built in Selby, England in 1839, and the Knippel Bridge, also a simple trunnion bascule, erected at Copenhagen in 1867 (Hovey 1926:I:80).

Bascule bridge design evolved rapidly during the late nineteenth and early twentieth centuries with the development of numerous patented types. Among the early notable bascule bridges were the Van Buren

Bridge in Chicago, a Scherzer rolling bascule, plans for which were completed in 1893, and the Tower Bridge in London, a roller bearing, trunnion bascule (McCullough 1923:1).

Bridge engineer J.A.L. Waddell defined modern bascule bridges as "those in which a shallow deck is raised from a horizontal position to a vertical or inclined one so as to let vessels pass." These bridges have either one or two leaves. The weight of these leaves is counterbalanced in a variety of ways, depending on the bridge design (Waddell 1898:105). The term "bascule" is derived from the French term for weighing device or seesaw (Jackson 1988:32).

The bascule bridge was preferred over other bridge types where one large clear channel was necessary for maritime passage. C.B. McCullough cited advantages of the bascule design: rapidity of operation; lack of interference with the channel during operation; and the relatively short duration of opening, among others (McCullough 1923:2). Disadvantages included the difficulty of maintenance and the amount of power necessary to operate its mechanism when the span was opened and exposed to wind pressure.

In designing a bascule bridge, an engineer had to consider whether to use a single or a double leaf type of bridge. State Bridge No. 0302150 is of the single leaf type. McCullough cites four major advantages of the single leaf type over the double leaf type:

1. Central power plant and control.
2. Greater rigidity under excessively heavy loads.
3. Only one counterweight pit to provide (where the roadway is so close to the water line as to make a pit necessary and where an underneath counterweight type is to be chosen).
4. Absence of the necessity for anchoring the rear end of the overhanging arm for live load with a consequent lessening of the churning action on foundations (McCullough 1923:32).

The bascule bridge was economically practical for spans requiring leaves no longer than 75 feet. Beyond that limit the cost of the structure was higher than that of the alternative, the lift bridge (Waddell 1898:105). The high cost of a longer bascule leaf is due in part to the great surface opposed to the wind by the leaf when the bridge was opened or closed. To overcome the pressure of the wind, powerful and expensive machinery had to be used, and this machinery had the potential of stalling in a high wind (Waddell 1898:107). In Waddell's opinion, all bascule bridges were "inherently ugly." However, from an engineering perspective he asserted that "they are scientific, and they represent, probably, the best and most profound thought that has ever been devoted to bridge engineering" (Spero 1991:58-59).

Two types of bascule bridges were described by Waddell in his 1898 book *De Pontibus*: the counterweighted bascule and the rolling bascule. In the rolling bascule, leaves end in a cylindrical surface that rolls on a plane, while in the counterweighted bascule the leaf lifts from one end and is balanced by a metal or concrete counterweight. In his 1916 book *Bridge Engineering*, Waddell listed three types of bascule bridges: the trunnion, the rolling lift, and the roller bearing types. These three types differ in the details of the moving mechanism. The trunnion bascule bridge moves about a fixed center of rotation located at the center of gravity of the rotating part. The roller-bearing bascule bridge also moves about a fixed center of rotation that coincides with the center of gravity. The trunnion is eliminated, and the load is carried by a segmental circular bearing on rollers in a circular tract. The rolling lift bascule bridge continually changes its center of rotation and shifts its load application points as its center of gravity moves in a horizontal line.

Various subtypes were developed and patented as improvements on the basic bascule bridge types. Trunnion bascule bridge types included the Strauss (Strauss Bascule Bridge Company), the Brown, Page, and Chicago (Chicago Bascule Bridge Company), and the Waddell and Harrington.

In his text *The Economics of Bridgework*, published in 1921, J.A.L. Waddell discussed the varieties of power sources used for movable bridges. As noted, the Bass River bridge uses a gasoline engine. In describing the use of gasoline engines, Waddell wrote:

> The modern multi-cylinder gasoline engine seems ideal for the operation of movable bridges, as it probably combines the greatest power and economy of operation with the least first cost, weight, and space; but it has not been used extensively on bridges on account of its high speed, 800 to 1200 R.P.M. or more, and the consequent large speed-reduction necessitated -- also on the requirement for friction clutches to enable the engine to be thrown into and out of gear, because such engines must be started before beginning to move the bridge, and must be run continuously during the cycle of operations. These difficulties can be overcome by the use of a hydraulic reducing-gear attached to the engine shaft and in turn driving a worm gear. By such an arrangement the clutches are eliminated, and a speed reduction from 40:1 to 100:1 may be obtained at once and the remaining reduction to be made with a short train of gears (Waddell 1921:313).

Otis Ellis Hovey, writing prior to the completion of the national electric network, compared steam and gasoline engines as power sources for bascule bridges:

> Gasoline engines are more economical than steam, but their starting torques are small and they are more likely to get out of order than steam engines. When electric current is not available, and a movable bridge is operated only a few times daily, gasoline-engine plants are the most economical and desirable of all types (Hovey 1927:II:2).

Hovey later described the operation of a gasoline bridge engine:

> The starting torque [of the gasoline engine] is practically zero. The running torque does not attain a magnitude that will start a bridge from rest, even with the assistance of the fly wheel, until the engine is running at a relatively high speed. As the starting torque is *nil*, the only practicable way to start the bridge is to allow the engine to run idle until it has attained a speed at which the torque has nearly or quite its maximum value, and then to start the machinery by means of a friction clutch, which is made so that the parts can slip without injury until the bridge is accelerated.
>
> The selection of the clutch is an important matter. No ordinary form of cut-off clutch will serve the purpose, for it would soon be worn out by the slipping and rubbing of the shoes. The best clutch for this service is a lubricated disc clutch of the general type of the Weston

or the Hele-Shaw designs. The rated capacity of the clutch should never be less than twice the normal output of the engine (Hovey 1927:II:103).

The Strauss Bascule Bridge

Joseph B. Strauss (1870-1938) developed the articulated counterweight bridge in 1905 (patent granted in 1911). An eminent civil engineer and principal in the Chicago firm of Strauss Bascule and Concrete Bridge Company, he was responsible for numerous bridge patents, as well as additional patents for railway cars and double hung windows. The articulated counterweight design became one of the most popular for lift bridges prior to World War II. He is best known for his role as chief engineer for the Golden Gate Bridge over San Francisco Bay (Jackson 1988:278, 280). Strauss also designed the Longview (Lewis and Clark) Bridge across the Columbia River at Longview, Washington, a 2,722 foot long cantilever truss (Jackson 1988:313).

The first Strauss bascule bridge, completed in 1905, was a single leaf, through riveted structure built for the Wheeling and Lake Erie Railroad over the Cuyahoga River in Cleveland (Hovey 1926:I:116). Among many other Strauss trunnion bascule highway bridges were a 78 foot long, pony truss span over the Elizabeth River in Elizabeth, New Jersey, completed in 1908; a 58-foot, deck plate girder span on Albany Street in New Brunswick, New Jersey, completed in 1919; and a 131.63 foot through riveted span over the Elizabeth River in Elizabeth, New Jersey, completed in 1921 (Hovey 1926:I:127). Hovey noted that by 1926 "there have been more bascule bridges built from the various Strauss designs than from those of any single type of bascule" (Hovey 1926:I:116).

The Strauss Bascule Bridge Company designed three general types of bascule bridges: 1) the vertical overhead counterweight type; 2) the underneath counterweight type; and 3) the heel trunnion type. The Bass River bridge was an example of the second of these types.

The design for the Strauss trunnion bascule bridge was described in Patent 995,813, issued in 1911. The design consists of a movable leaf (indicated as part A), mounted upon a support so that it can be lifted to open the way spanned by the movable section. The movable section has a rearwardly projecting part which extends to the rear of the points where it is supported. In the patented design, the stationary supporting parts B^1 are placed, one on each side of the roadway to which are riveted the cross girders B^2 carrying the trunnions or bearings B on which the movable section rests and turns.

Associated with the movable section is a counterweight C. This counterweight is equipped with connecting pieces C^1 and C^2, by means of which it is connected to the end of the movable section by a pivotal connection C^3. Suitable apparatus is provided to operate the movable section. In the patent application, the apparatus consists of the operating struts E which are connected at one end with the movable section. These operating struts are provided on their under surfaces with racks E^2 which are engaged by pinions E^3 connected with suitable motors E^4. These operating struts pass through frames E^5 which are pivoted on the pinion shafts E^6 so as to be free to rock as the position of the strut varies.

A compensating counterweight F is connected with each operating strut. The counterweight is connected by a link F^1 with the frame E^5. The compensating counterweight is mounted on the strut so that the strut can move in relation to it. This compensating counterweight varies in position with relation to the strut in order to balance the upward projecting end as the strut is moved upwardly to lift the moveable section. As the strut passes back, its free end overhangs the pinion, while the length and weight of the end attached to the moveable section decreases in respect to the pinion. The counterweight remains constant in relation to the pinion. Its mass is such that it overbalances the strut in its extreme position. Thus, the effect on both the movable section and the pinion remains constant. When the movable section is to be lifted, the motors are operated. By means of the pinions and racks the struts pivot and pull the movable section upward. When the bridge is completely lifted, the movable section and counterweight assume the position shown by dotted lines in the elevation drawing included with the patent (Joseph B. Strauss 1911).

The counterweight beneath the bridge deck design is less common than the overhead counterweight design. Examples of the latter are found at Green Bank on the Mullica River and Federal Street in Camden, both in New Jersey. The parallelogram-linked counterweight that moves parallel to itself when the bridge is in operation allows a lighter counterweight and eliminates the need for a deep counterweight pit.

Hovey described the means of achieving balance with the counterweight:

> The center of gravity of the moving leaf is at *g* and that of the counterweight at *g'*. Trunnion *A* and attachment *B* are in the same plane as *g* and link *CD* is parallel to *gAB*. *ABDC* is a parallelogram. Hence, in any position, closed or in motion, $Px = Wy$ or $Px' = Wy'$; and a balance is maintained throughout the movement of the leaf....The counterweight may be extended above the attachment *B* and cored out to clear the floor framing, when a compact arrangement is necessary.....The break in the floor is in front of the trunnions (Hovey 1926:I:116-119).

Chain-driven moveable bridges are uncommon, although the arrangement is appropriate when the power source and drive shafts are not closely spaced or the bridge is located in an area prone to high water that might inundate the engine or motor. The use of chains and sprockets eliminates the need for several sets of reduction gears. No other chain-driven bridges are believed to exist in New Jersey. Two others are known to survive elsewhere: a Quinnipiac River bridge in New Haven, Connecticut, and the ca. 1900 New York, New Haven and Hartford Railroad bridge over the Sakonnet River at Tiverton, Rhode Island. Both of these bridges are powered by electric motors. State Bridge No. 0302150 is the only known chain driven bridge powered by a gasoline engine remaining in the United States.

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UNITED STATES PATENT OFFICE.

JOSEPH B. STRAUSS, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE STRAUSS BASCULE AND CONCRETE BRIDGE COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

BRIDGE.

995,813. Specification of Letters Patent. Patented June 20, 1911.

Application filed December 18, 1905. Serial No. 192,208.

To all whom it may concern:

Be it known that I, JOSEPH B. STRAUSS, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Bridges, of which the following is a specification.

My invention relates to bridges and particularly to bascule, and has for its object to provide a new and improved bridge of this description.

My invention is illustrated in the accompanying drawings, wherein—

Figure 1 is a side elevation of a bridge embodying my invention; Fig. 2 is a plan view of the device shown in Fig. 1; Fig. 3 is a side elevation with parts omitted showing a modified construction; Fig. 4 is an end view of Fig. 3.

Like letters refer to like parts throughout the several figures.

Referring now to the drawings, A is the movable leaf, span or section extending across the part to be bridged. This movable section may be made up in any desired manner, and is mounted upon a support so that it may be lifted to open the way spanned by the movable section. The movable section has a rearwardly projecting part which extends to the rear of the points where it is supported. As herein shown, the stationary supporting parts B^1 are provided, one on each side of the roadway to which are riveted the cross girders B^2 carrying the trunnions or bearings B on which the movable section rests and turns. Associated with the movable section is a counterweight C which may be of any desired construction. This counterweight is provided with connecting pieces C^1 and C^2, by means of which it is connected to the end of the movable section by a pivotal connection C^3. The counterweight C is also connected by links C^4 with a stationary supporting device projecting above the roadway. As herein shown, there are two such devices, D, one on each side of the roadway. It will thus be seen that the counterweight ordinarily stands up above the roadway, and that it is pivotally connected to the movable section A, and that it is also pivotally connected to the upwardly projecting stationary supports or towers D extending up above the roadway. These stationary supporting devices D are preferably arranged so that the movable section when lifted passes up between them. The counterweight at the same time passes downwardly and inwardly between them.

Some suitable apparatus is used to operate the movable section. As herein shown, this apparatus consists of the operating struts E which are connected at one end with the movable section in any desired manner, as, for example, by being connected with the cross girder E^1 running transversely across the movable section and underneath it. These operating struts are provided on their under surfaces with racks E^2 which are engaged by pinions E^3 operatively connected with suitable motors E^4. These operating struts pass through frames E^5 which are pivoted on the pinion shafts E^6 so as to be free to rock as the position of the struts varies. A compensating counterweight F is connected with each operating strut, said counterweight being connected by a link F^1 with the frame E^5, the link being pivoted thereto. The compensating counterweight is mounted upon the strut so that the strut can move with relation to it, and this compensating counterweight therefore varies in position with relation to the strut so as to balance, as it were, the upwardly projecting end thereof as the strut is moved upwardly to lift the movable section. As the strut passes back its free end overhangs the pinion while the length and weight of the end attached to the movable section decreases in respect to the pinion so that there would ultimately be an uplift at point F^2. The counterweight, however, remains constant in relation to the pinion, and its mass is such that it overbalances the strut in its extreme position and thus keeps the effect on both the movable section and pinion constant. When it is desired to lift the movable section the motors are operated, and by means of the pinions and racks the struts are moved so as to pull the movable section upwardly moving it above the trunnion connections. When the bridge is completely lifted the movable section and counterweight take the position shown in dotted lines in Fig. 1. In this construction the connecting piece C^1 is equal in length to the distance between the center of the trunnion B and the pivot C^3 and is parallel to a line drawn through these two points. Also a line drawn through the

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points B and the central point C^3 of the connection C^4 (see Fig. 1) is equal and parallel to a similar line drawn through the point C^5 and point C^6. These lines with the two fixed points B and C^5 and two moving points C^4 and C^3 form the elements of a parallel motion so that as the movable section rises and moves in toward the trunnion the counterweight descends and moves in toward the trunnion in equal ratio, and thus the counterweight arm remains constant and the center of gravity remains in the center of the trunnion keeping the bridge in equilibrium throughout its movement.

I prefer to provide a means for protecting the end of the bridge from extreme high water, that is, to prevent the end of the bridge from dipping down into the water when the movable section is lifted. As shown in Fig. 1, for example, this result is secured by providing a casing G supported upon the piers or bridge supports and arranged so that the end of the bridge can pass down into it. This casing may be made of any desired material, such as concrete steel, or the like, and is provided with an automatic drip which allows all water that may accumulate thereon on account of rain or the like to escape. It will be seen that in case of high water this casing will provide a pit, as it were, for the rear end of the movable section, and thus protect it from the water. As will be seen the bottom of the casing is above the normal level of the water.

In Figs. 3 and 4 I have shown a modified construction wherein the counterweight and the supporting devices therefor are used for the purpose of producing an ornamental design. The parts of this construction are similar to those illustrated in Fig. 1, except that the supporting parts D are provided with some suitable ornamental design, H, and the counterweight C is located so as to bridge the space between the parts D and is also provided with some suitable ornamental design H^1. The counterweight C in this case is preferably thinner and deeper and is arranged so that when the bridge is down the counterweight coöperates with the supporting parts so as to form a unitary design, as, for example, by having its face flush with the edges thereof. The counterweight C is shown in Fig. 3 in dotted lines, and is provided with connecting pieces C^1 and C^2 pivoted to the end of the movable section, and also the connecting pieces C^4 at the top connecting the counterweight with the supporting devices D. The other parts of the bridge are similar to those shown in Fig. 1, and I have not, therefore, illustrated them in detail.

The floor of the main span ends at the trunnions and the floor, I, of the approach from the shore end to this point is fixed. The trunnions H, which as before stated are supported upon the stationary cross girders B^2 form the pivotal points about which the bridge turns. It will thus be seen that if the truss members of the main span extended back beyond the trunnions they would engage these cross girders B^2 as the bridge was turned up, and thus prevent its further movement. In order to prevent this the main truss members end at the trunnions, and the rear end of the main span is provided with truss members K, K^1, K^2, K^3 which completely surround the cross girders B^2, that is the cross support for the said main span. The truss member K^3 projects downwardly and forwardly and the truss member K projects from the rear end of the bridge downwardly and is engaged by the truss member K^2 and then passes upwardly to the main span. It will be seen that by this construction the cross support for the main span or movable section does not in any manner interfere with the lifting of the bridge.

In constructing the counterweight I prefer to first construct a box of suitable size and shape open so the interior is accessible. The box is then filled in with loose counterweight material of any suitable kind. I may, for example, first place in the box large pieces of material and then fill in the interstices with smaller pieces or fine material until the total weight of box and material and associated parts provide the desired weight. By means of the connections herein shown the bo . . prevented from tilting as the bridge is lifted and lowered, and hence the spilling of the counterweight material prevented. When the bridge is closed the counterweight is high enough above the roadway to leave a passageway beneath for vehicles and persons. When the bridge is opened the counterweight lowers to substantially the level of the roadway so as to act as a barrier across the roadway.

It will be noticed that the counterweight is associated with and supported by a compound lever having a member pivoted to a fixed support, and a second member pivoted to said first member at one end and to the shore or rearwardly projecting end of the bridge span at its other end, and that one of said lever members is substantially parallel to a line which passes through the pivot of the bridge span and the point of pivotal attachment of the second lever member to said bridge span, and the other lever member substantially parallel to a line through the said pivot of the bridge span and the point of pivotal attachment of said first lever member to its support.

It will be noted that the counterweight is separated by a considerable space from the bridge itself, that is, from the main girders,

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said counterweight being at a considerable height above them. It will further be noted that the counterweight moves in a curve between the clearance line of the bridge and the roadway as the bridge opens, that is, the path of the counterweight is a curve extending from the clearance line of the bridge toward the roadway. The counterweight is suspended from or attached to a fixed part, and also to a movable part.

I claim:

1. A bridge comprising a movable section, a counterweight therefor, a supporting device for the counterweight extending upwardly above the roadway, a pivotal connection from said counterweight to the end of said movable section back of the point about which it moves and a second pivotal connection from said counterweight to said supporting device.

2. A bridge comprising a movable section, a counterweight therefor, a supporting device for the counterweight projecting up above the roadway, a connection extending downwardly from said counterweight and pivoted to the end of the movable section, a second connection leading from the counterweight and pivoted to the said supporting device above said counterweight.

3. A bridge comprising a movable section having a pivotal connection with a supporting device, the rear end of said section projecting past said pivotal connection, said supporting device extending upwardly above the roadway, means for moving the said section about said pivotal connection, a counterweight for said movable section and pivotally connected to the movable section at its extended rear end and the upwardly extending part of the said support.

4. A bridge comprising a movable section, a counterweight therefor and a parallel link mechanism for said counterweight comprising at least two movable members connected together so as to be parallel to each other in all of their various positions.

5. A bridge comprising a movable section, a counterweight therefor, two supports for the counterweight one on each side of the roadway and projecting thereabove, said counterweight carried upon the movable section and extending across the roadway so as to form a portal over said roadway.

6. A bridge comprising a movable section, an overhead counterweight therefor, fixed supports on each side of the roadway, the counterweight mounted upon the movable section and connected with said fixed supports so as to form a portal across the roadway.

7. A bridge comprising a movable section, a fixed support extending above the roadway, a counterweight extending across and above the said roadway and connected with said fixed support and mounted upon said movable section so as to leave a passageway beneath it when the bridge is closed.

8. A bridge comprising a movable section, a fixed support extending above the roadway, a counterweight carried upon the movable section and extending across and above the said roadway and connected with said fixed support and said movable section so as to leave a passageway beneath it when the bridge is closed, mechanism for moving said movable section and counterweight so as to open the bridge, said counterweight acting as a barrier across the roadway when the bridge is open.

9. A bridge comprising a movable section, a stationary cross support therefor, the rear end of the movable section having truss members which completely surround the said cross support.

10. A bridge comprising a movable section, two upright supports therefor, one on each side of the roadway, a stationary cross support connected with said upright supports and upon which the movable section is mounted the main trusses of the movable section ending at the said cross support, the rear end of the movable section having truss members above and below said cross-support and arranged so as to at all times be free from the cross support when the movable section is lifted.

11. A bridge comprising a movable section, an ornamental portal associated therewith, a portion of said portal movably held in position and a rigid connection between said movable portion of said portal and said movable section so that said portal acts as the counterweight for the movable section.

12. A bridge comprising a movable section mounted upon trunnions and having a rearwardly projecting end, a counterweight therefor located above the roadway when the movable section is in its operative position, and a connection between said counterweight and said rearwardly projecting end of the movable section.

13. A bridge comprising a portal located above the roadway leading to the bridge and extending thereacross, a rigid connection from said portal to said movable section whereby said portal acts as a counterweight for said movable section.

14. A bridge comprising a movable section, a box above the roadway and extending thereacross and pivotally connected with the end of said section and containing counterweight material and means for preventing the tilting of said box as the movable section is lifted so as to prevent the spilling of the counterweight material.

15. A bridge comprising a movable section, a box connected with said movable section and located above the roadway, and containing removable counterweight material, and a connection from said box to a sta-

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[illegible] part arranged to prevent said box from tilting when the movable section is lifted.

16. A bridge comprising a movable section, an ornamental device located above the roadway and a rigid connection between said ornamental device and said movable section, said ornamental device acting as the counterweight therefor.

17. A bridge comprising a movable section, stationary supports extending thereabove, a counterweight connected to said supports and to the movable section, the connection between the counterweight and said supports being pivoted both to the counterweight and the supports.

18. A bridge comprising a movable section, a stationary part, an operating mechanism comprising an operating strut connected with the movable section and the stationary part, a motor mechanism operatively connected with said operating strut so as to move it to lift the movable section, and means for preventing the weight of said strut from unbalancing the movable section.

19. A bridge comprising a movable section pivoted between its ends and having a rearwardly projecting part projecting beyond the pivotal points, a support extending above the roadway, a counterweight mounted upon the rearwardly projecting end of the movable part and movably connected with said support.

20. A bridge comprising a movable section, an operating strut connected therewith, a rack on said operating strut, a pinion engaging said rack, a motor mechanism operatively connected with said pinion, and a counterweight for said strut movably mounted thereon.

21. A bridge comprising a movable section mounted upon pivots and provided at each side with a truss, a counterweight above the roadway pivotally connected to both trusses of said movable section so as to vary its distance from the pivots upon which said movable section is mounted as said section is lifted and lowered.

22. A bridge comprising a movable section, a counterweight therefor above the clearance line of the bridge a rigid connection between said counterweight and the bridge, said counterweight held in position so that it moves in a curve extending from the clearance line of the bridge toward the roadway when the bridge is open.

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Witnesses:

HOMER L. KRAFT,
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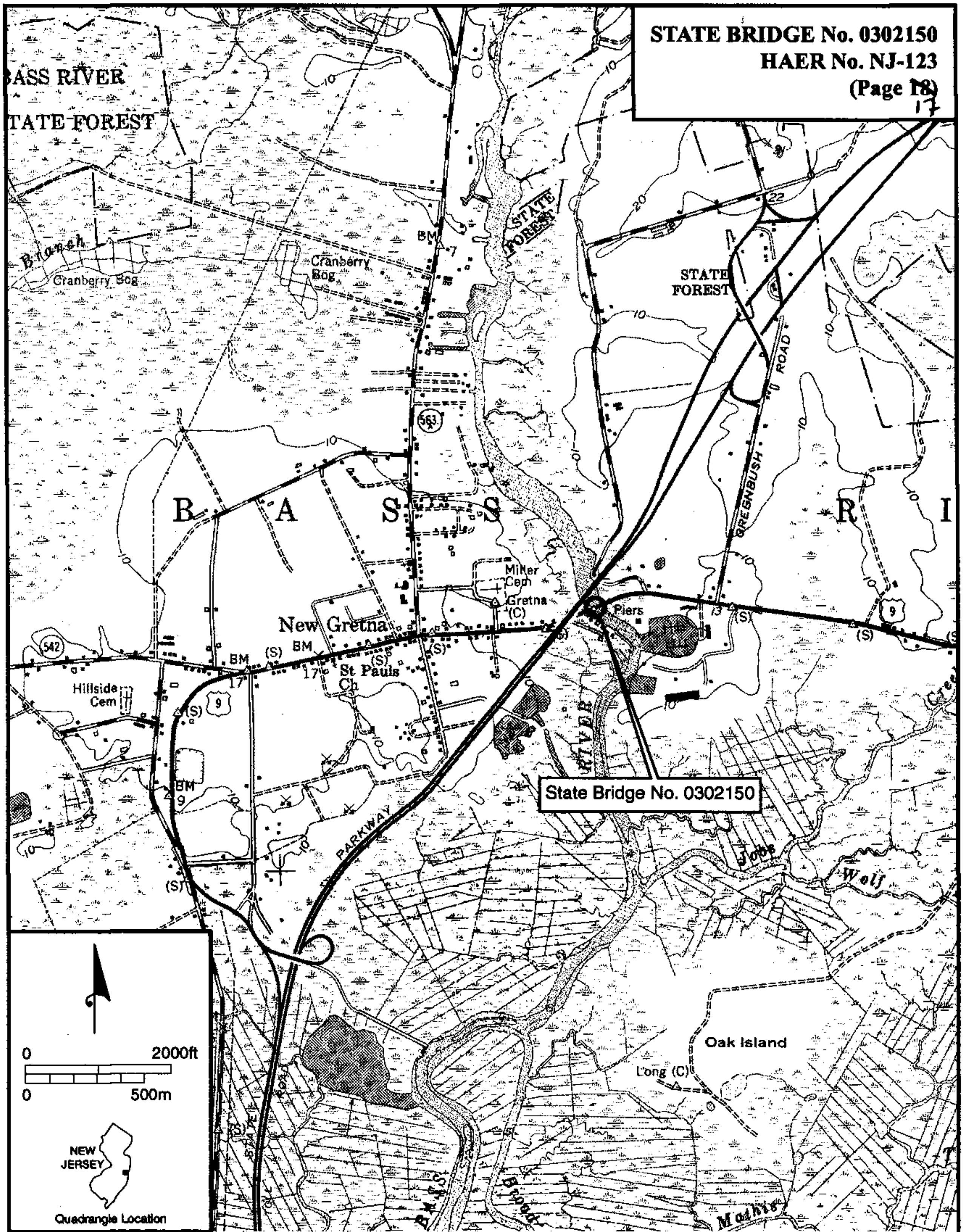
Bridge. Specification of Letters Patent No. 995,813. Page 4 (Joseph B. Strauss 1911).



Detail of *New Gretna, N.J.*, 7.5-minute quadrangle (USGS 1951, photorevised 1972, photoinspected 1977), showing State Bridge No. 0302150.

STATE BRIDGE No. 0302150
HAER No. NJ-123
(Page ~~20~~ 19)

J. B. STRAUSS.
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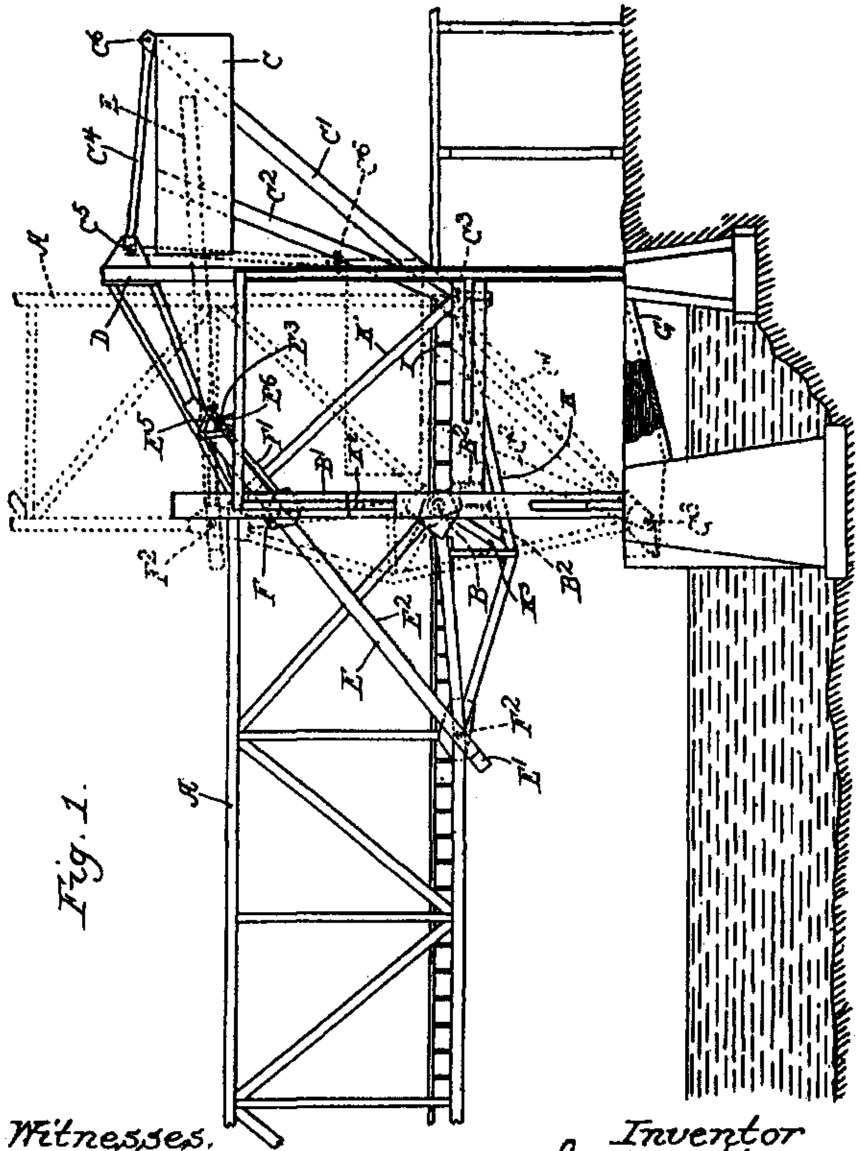
APPLICATION FILED DEC. 10, 1906.

995,813. **Patented June 20, 1911.**

2 SHEETS—SHEET 1.



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Bridge. Elevation. Patent No. 995,813 (Joseph B. Strauss 1911).

J. B. STRAUSS.
BRIDGE.
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995,813.

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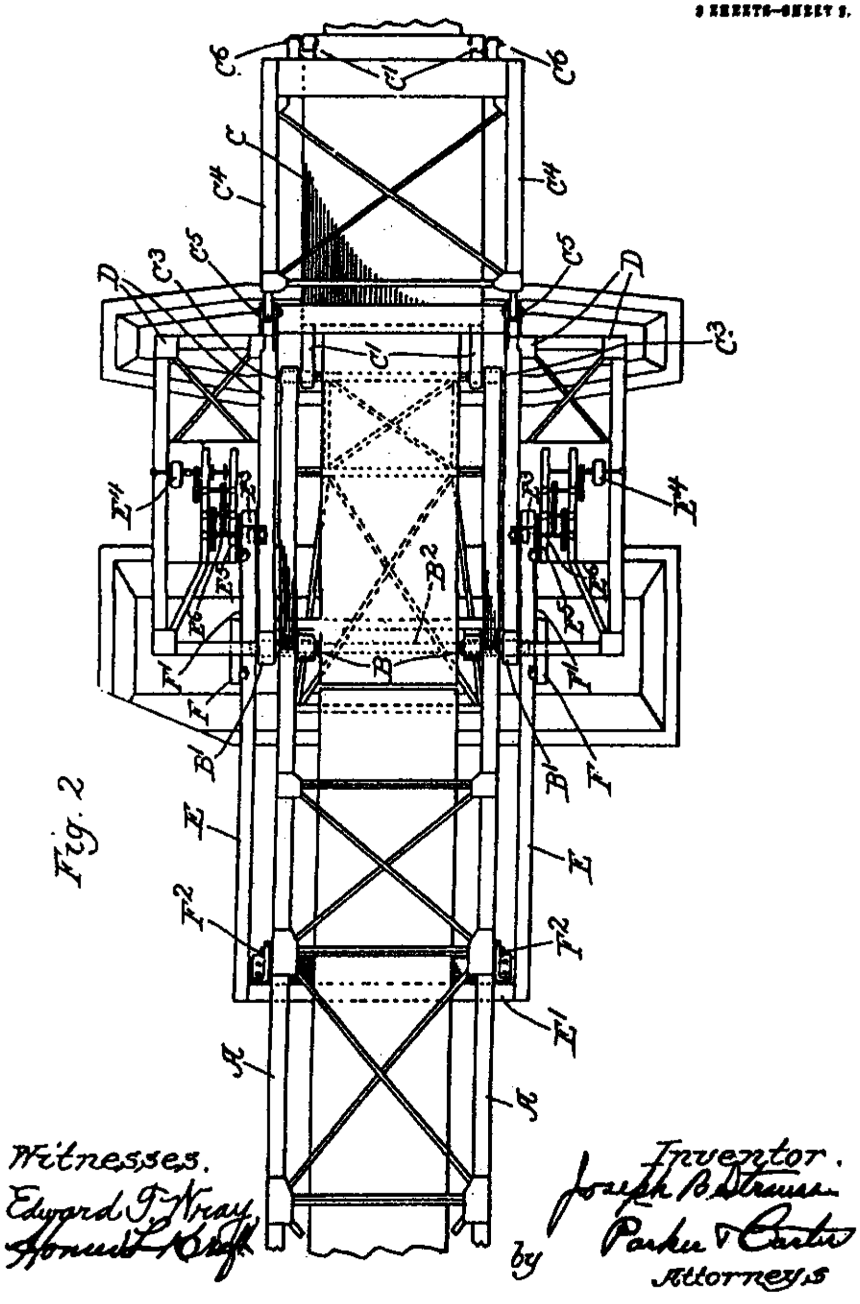

Bridge. Top view. Patent No. 995,813 (Joseph B. Strauss 1911).

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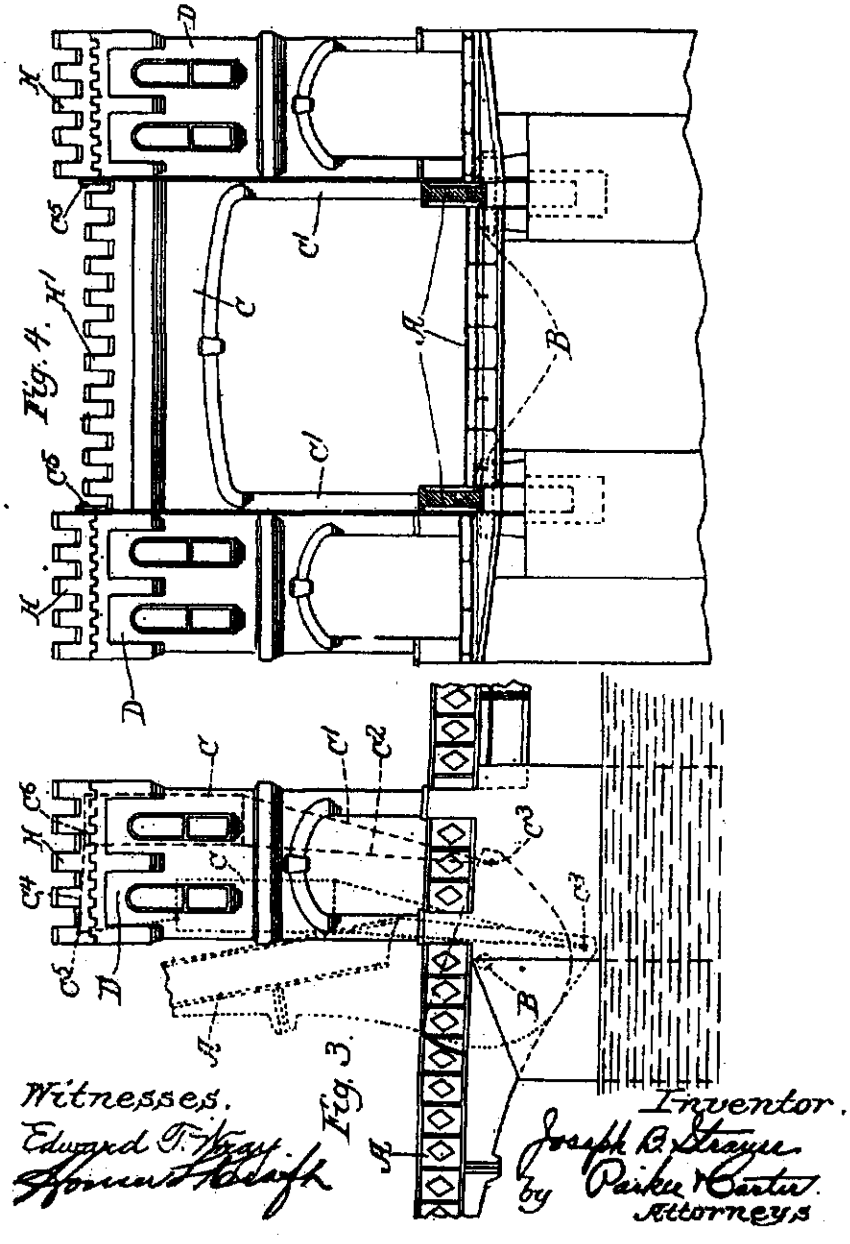
APPLICATION FILED DEC. 14, 1906.

995,813.

Patented June 20, 1911.
3 SHEETS—SHEET 3.



Bridge. Elevation and section. Patent No. 995,813 (Joseph B. Strauss 1911).